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ATLAS SCT Power Supply System

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The ATLAS SCT (semiconductor tracker) comprises 2112 barrel modules mounted on four concentric barrels of length 1.8m and up to 1m diameter, and 1976 endcap modules supported by a series of 9 wheels at each end of the barrel.

Each module is powered by its own independent, floating low and high voltage power supplies, referenced to ground at the detector shield. Correspondingly each module has its own, distinct cable chain all the way back to the service cavern.

This presentation outlines the structure and specification of the SCT Power Supply System, including the high level control software and operational model.

Summary

In the ATLAS service caverns, the SCT power supply system comprises a total of 22 racks. In addition to standard units such as the turbine, deflector and heat exchangers, each rack contains two power pack shelves, one circuit breaker box (CBB), four fan trays and four SCT power supply crates. Each power supply crate services up to 48 SCT modules. It houses 12 LV cards of four channels each, 6 HV cards of 8 channels each, one SCT Interlock Card (SIC), one Crate Controller card (CC), and one shorting card (for safety reasons).

Each LV channel provides analogue and digital power to one module, as well as two low current control lines, bias for two NTC thermistors used to monitor the module temperature, and bias for the on-detector part of the opto-electronic readout scheme. Sense wires are provided for all high current lines. Each HV channel provides up to 500V bias to the silicon sensors of one module. Both LV and HV supplies may be controlled, and monitored parameters may be readout, by means of a parallel bus implemented on the crate backplane.

Power input to the LV and HV cards is at 48V DC, supplied by four commercial units housed in the power pack shelves. All units are connected to a common bus, power being distributed to the crates through minature circuit breakers housed in the CBB. Only three power packs are needed to power four fully loaded crates: the fourth power pack provides redundancy. At each LV/HV card, an oscillator block modulates the 48V DC input: each channel is isolated by means of a transformer. Each group of four channels is associated with a hardware interlock line, electrically isolated by means of opto couplers on the SIC card, to provide a safety interlock which does not depend upon software.

The crate controller interfaces an ELMB card to the crate backplane to provide a link between the power supply channels and CAN bus. Three user defined sets of channel parameters, corresponding to operational states of the detector, are stored in the ELMB's non-volatile memory such that common operations may be performed with a minimum of bus traffic.

The highest levels of the SCT Power Supply software take the form of a Supervisory Control and Data Acquisition system, PVSS II. The software is distributed between 9 PCs, 8 systems each being connected to 11 PS crates over CAN bus.

The top layer solution for the overall control of ATLAS takes the form of a Finite State Machine (FSM) written in SMI++. Accordingly an FSM has been built following the operational model of the SCT power supplies, with channels grouped together according to the physical cooling structures of the detector. The physical routing of the SCT

power cables dictates that, in many cases, the PS channels servicing the modules of a single cooling structure are distributed amongst several PS crates. This has added greatly to the complexity of the control software.

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